

Guide tube for a flexible pipe for transporting  
hydrocarbons

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The present invention relates to a tube for guiding a  
5 flexible pipe for transporting hydrocarbons, more  
commonly known as a guide tube.

The present invention is designed for offshore oil  
exploration and, more particularly, for surface  
10 offshore installations to which said flexible pipes are  
designed to be connected. These flexible pipes are of  
the type described in API (American Petroleum  
Institute) specifications 17J and 17B.

15 Known "J" guide tubes mounted vertically on an anchored  
floating support structure, for example, an oil  
platform, already make it possible to guide and to  
protect flexible pipes, one end of which is drawn on  
board the platform in order to be connected thereto.

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Said guide tube comprises a lower tubular element that  
is generally submerged and has a substantially  
rectilinear section extending along an axis and  
extended by a free section having a curvature. This  
25 free section has an inner wall internal to the  
curvature against which said flexible pipe is fitted so  
as to be entrained in friction when entrained through  
said guide tube.

30 Furthermore, with a view to limiting the flexing of the  
flexible pipe in the vicinity of said free section,  
which could damage it, a bend limiter is fitted when  
said pipe is installed. This limiter consists of a bend  
stiffener made from flexible material, for example  
35 polyurethane, mounted fixedly on said free section and  
forming a sleeve surrounding the pipe in order to  
restrict its range of movement. A bend limiter of this

type is described, in particular, in document  
FR 2 689 603.

A further embodiment disclosed in that document  
5 consists not in connecting the bend limiter directly to  
said free section, which is rigid, but in connecting it  
to a tubular member forming a sleeve that is mounted  
securely around the pipe, projecting and sliding in  
10 said free section. In this way, despite the low-level  
longitudinal movements of the flexible pipe in the  
guide tube, which gives rise to sliding of the tubular  
member in the free section, it remains secure and in  
the extension of said free section. Thus, the tubular  
15 member is held clear and the bend limiter extending it  
fulfills its role, just as in the preceding embodiment.

On the other hand, whereas in the installation method  
of the preceding embodiment, the flexible pipe was  
capable of being entrained longitudinally in friction  
20 in the bend limiter, in this latter embodiment this  
does not occur since the bend stiffener is mounted  
fixedly on the flexible pipe in terms of running  
length.

25 Nevertheless, in the two embodiments, the flexible pipe  
is likely to be entrained in friction against the  
internal inner wall inside the curvature of said free  
section, which risks damaging it.

30 A problem that arises and that the present invention  
aims to solve is thus that of proposing a guide tube  
allowing entrainment of the flexible pipe in said lower  
tubular element without thereby damaging the flexible  
pipe.

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To that end, the present invention proposes a guide  
tube for a flexible pipe for transporting hydrocarbons  
and designed for mounting substantially vertically on

an offshore installation to allow connection of said flexible pipe to said offshore installation, said guide tube comprising a lower tubular element having a substantially rectilinear section extending along an axis and extended by a free section having a curvature, said free section having an inner wall internal to the curvature against which said flexible pipe is fitted so as to be entrained in friction when entrained through said guide tube, and said rectilinear section comprising eccentric guide means for guiding said flexible pipe in order to hold it away from said axis in an opposite direction from said curvature so as to keep said pipe away from said internal inner wall.

Thus, a characteristic of the invention lies in the implementation of the eccentric guide means on the rectilinear section of the tubular element, which allow the flexible pipe to be held away from the axis of the rectilinear section when it is entrained in the guide tube. In this way, the pipe is also held away from the internal inner wall inside the free section and can no longer rub against it when it is entrained, which considerably reduces its wear during the procedure of installing and disconnecting the pipe.

According to one embodiment, the eccentric guide means comprise an insert forming a ring, said insert having an inner perimeter that is eccentric relative to the outer perimeter. Thus, the central space of the insert, delimited by the inner perimeter and whose dimensions are smaller than the circumference of the rectilinear section, is offset relative to the axis of this section, toward its wall. Naturally, the central space of the insert is sufficiently large to allow passage of the flexible pipe.

According to a variant embodiment, said eccentric guide means are adapted so as to be held in a bearing

relationship against a flange of said substantially rectilinear section. Thus, the eccentric guide means are completely secure in translation of the rectilinear section of the tubular element, along its axis.

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According to this variant, and in a particular embodiment, the eccentric guide means are adapted so as to be held in a bearing relationship against said flange by a collar forming a clamp. In this way, the  
10 eccentric guide means are easily connected to the rectilinear section and held there firmly.

In order to minimize friction forces on the flexible pipe, said eccentric guide means are made from steel  
15 and have a surface with a low friction coefficient.

Furthermore, according to a further embodiment of the invention, the guide tube comprises at least one upper tubular element spaced from said lower tubular element,  
20 opposite said free section and arranged coaxially relative to said substantially rectilinear section. Thus, use of a very long tube is avoided, it sufficing to use two tubular elements spaced from one another vertically, as will be explained in greater detail  
25 below.

Further special features and advantages of the invention will become apparent from reading the following description of particular embodiments of the  
30 invention that are given by way of indication but not limitation, with reference to the appended drawings, in which:

- Figure 1 is a diagrammatic perspective view of a tubular element according to one embodiment;

35 - Figure 2 is a diagrammatic plan view of a detail illustrated in Figure 1;

- Figure 3 is a diagrammatic view in vertical section of the invention illustrated in Figure 1

according to a first use stage;

- Figure 4 is a diagrammatic view in vertical section of the invention illustrated in Figure 1 according to a second use stage; and

5        - Figures 5 and 6 illustrate the invention according to a further object.

Figure 1 illustrates a lower tubular element 10 of a guide tube having a rectilinear section 12 extending  
10 along an axis A of symmetry, this rectilinear section 12 being extended by a free section 14 curved with a certain curvature.

Furthermore, this Figure 1 shows a flared edge 16  
15 surmounting the rectilinear section 12, forming a flange and providing a substantially frustoconical space. This frustoconical space accommodates an eccentric ring 18 that itself has is a frustoconical portion for insertion perfectly in said space. It is  
20 produced, for example from steel coated with an organic material capable of protecting it and of reducing the friction coefficient of its surface.

Thus, the eccentric ring 18 is immobilized in  
25 translation and can no longer be further pushed inside the rectilinear section 12.

On the other hand, in order to immobilize it completely in translation relative to the rectilinear section 12,  
30 the eccentric ring 18 is held by a removable collar 20 forming a clamp, consisting of two half-parts 22, 24 jointed together.

The half-parts 22, 24 have a U-shaped section defining  
35 two shoulders 26, 28 opposite one another, one 26 being adapted so as to bear behind the flared edge 16 and the other 28 being adapted so as to bear against the edge of the eccentric ring 18 in order to immobilize it in

the frustoconical space.

Naturally, locking of the eccentric ring 18 is subject to the folding of the two half-parts 22, 24 toward one another and their locking using closure means 29. As will be explained below, locking must be sufficient also to immobilize the eccentric ring 18 in rotation relative to the rectilinear section 12.

Figure 2 shows the eccentric ring 18 in plan view and also the position of the axis A of the cylindrical section 12 not shown here. Thus, the inner space 30 of the eccentric ring 18 delimited by its inner circumference 32 is eccentric relative to its outer circumference 34, which is itself adapted so as to coincide with the flared edge 16 of the rectilinear section 12 such that it has a thick edge 35 opposite a thin edge 36.

Figure 3 shows, in section, the tubular element 10 with its rectilinear section 12 and its curved free section 14. This free section 14 has an inner wall 38 internal to the curvature. It will be noted, and this is one characteristic of the invention, that the thin edge 36 of the eccentric ring 18 is oriented in an opposite direction from the curvature relative to the axis A of symmetry of the rectilinear section and, consequently, the thick edge 35 is oriented toward the curvature. That being the case, it will henceforth be understood why it is necessary for the eccentric ring 18 to be integral in rotation with the rectilinear section 12 since it must retain this position at all costs.

Thus, the thick edge 35 forming a stop offset toward the axis A of symmetry constitutes the eccentric guide means.

This Figure 3 also shows a flexible pipe 40 whose end

42 is entrained vertically by a line 44 through the tubular element 10 in order to be connected to an upper tubular element 46 illustrated in Figure 4 and described below.

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Figure 3 shows that the end 42 of the flexible pipe 40 and, more precisely, a connector 48, bears against the thick edge 35 of the eccentric ring 18 and by virtue of this thick edge 35, when it is pulled, the flexible pipe 40 will tend to be moved away from the axis A of symmetry in an opposite direction from the curvature so as to hold the pipe 40 away from the internal inner wall 38. In this way, friction of the flexible pipe 40 against the internal inner wall 38 is at the very least reduced and, at best, prevented, which safeguards the flexible pipe 40 against wear.

Figure 4 shows the pipe 40 extended in a guide tube comprising the lower tubular element 10 and the upper tubular element 46 held spaced from one another. It also shows the eccentric ring 18 inserted in the flared edge 16 of the rectilinear section 12.

Furthermore, according to this particular embodiment, the flexible pipe is surrounded by a sleeve 50, to which it is secured, embedded in the free section and extended by a bend limiter.

In this embodiment, the curvature of the free section is small such that the flexible pipe 40 is free relative to its internal inner wall and also relative to the eccentric ring 18. On the other hand, with a more curved free section, the flexible pipe would bear against the thick edge of the eccentric ring, which would thus limit the bearing forces of the pipe on the internal inner wall and thus the friction forces. In this way, the flexible pipe would be damaged less by any relative displacements of the pipe and the free

section.

According to a further object, the present invention  
proposes means for radially guiding a flexible pipe  
5 inside a tubular element.

Figure 5 shows a flexible pipe 60 extended entirely in  
a guide tube in a manner similar to that shown in  
Figure 4 and traversing a lower tubular element 61 that  
10 has no eccentric ring. On the other hand, in this case,  
the pipe is provided with biconical sleeves 62 that  
completely surround the pipe 60 and are held in a fixed  
position relative to it and spaced from one another.

15 These biconical sleeves 62, described below, are  
adapted so as radially to guide the flexible pipe 60,  
particularly in the tubular element 61 when it is  
entrained longitudinally for connection.

20 The biconical sleeves 62 have a radial section  
corresponding to the inner section of the lower tubular  
element in order, on the one hand, to slide freely in  
said tubular element and, on the other hand, to keep  
the flexible pipe at a distance from the inner wall of  
25 the lower tubular element 61 and, in particular, from  
the internal inner wall of its free section 64. Thus,  
the flexible pipe is safeguarded against friction and  
thus against wear.

30 Figure 6 shows a biconical sleeve comprising a central  
clamp 66 mounted on a tubular member 68 extending  
symmetrically on either side of said central collar 66  
along an axis B of symmetry. The central collar 66  
surrounds a median part 70 of the tubular member 68  
35 that itself has an inner surface 69 in contact with the  
flexible pipe and an outer surface 71. The tubular  
member 68 extends from the median part 70 on the one  
hand, so that the inner surface 69 flares out in order



to move away from the axis B of symmetry and, on the other hand, so that its outer surface 71 converges toward the axis B of symmetry.

5 Thus, by virtue of the flared inner surface 69 the flexible pipe is adapted to be flexed substantially, which enables the mean stiffness of the pipe to be reduced. Furthermore, the outer surface 71 is adapted to make it easier for the biconical sleeves to slide in  
10 the tubular elements.

According to a particular embodiment of the invention (not shown), use is made both of biconical sleeves for guiding the flexible pipe in the lower tubular element  
15 and eccentric guide means consisting of an eccentric ring. This eccentric ring is mounted on the lower tubular element in a similar manner to the first subject of the invention, but the section of the biconical sleeves is in this case smaller or  
20 substantially equivalent to the inner section defined by the eccentric ring and no longer by the inner section of the tubular element, so that it can traverse it freely.

25 In addition, according to a particular characteristic, the biconical sleeves are spaced along the flexible pipe by a distance shorter than the total length of the lower tubular element so that the flexible pipe is always guided radially by at least one biconical sleeve  
30 sliding in the lower tubular element when it is entrained therein.